

Date: Tuesday, 14/04/2009 11:28:09 AM  
 User: Linda Lacelle

## Process Sheet

<b>Customer</b> :	CU-DAR001 Dart Helicopters Services	<b>Drawing Name</b> :	212/205 HIGH FED X-TUBE ASSEMBLY
<b>Job Number</b> :	47145		
<b>Estimate Number</b> :	13216		
<b>P.O. Number</b> :		<b>Part Number</b> :	D212664101TRN
<b>This Issue</b> :	14/04/2009	<b>S.O. No.</b> :	
<b>Prsht Rev.</b> :	NC	<b>Drawing Number</b> :	D212-664-141 REV C
<b>First Issue</b> :	/ /	<b>Project Number</b> :	N/A
<b>Previous Run</b> :	46869	<b>Drawing Revision</b> :	C
<b>Written By</b> :		<b>Material</b> :	
<b>Checked &amp; Approved By</b> :		<b>Due Date</b> :	21/04/2009
<b>Comment</b> :	Est Rev:A 08-03-06 new issue DD verified by:ec Est Rev B 08.04.02 removed Polish EC verified by: DD		

**Qty:** 1 **Um:** Each

## Additional Product

Job Number:



<b>Seq. #:</b>	<b>Machine Or Operation:</b>	<b>Description :</b>
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1.0	D6005128	Crosstube Material
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**Comment:** Qty.: 1.0000 Each(s)/Unit Total: 1.0000 Each(s)

Pick:

Qty	Part number	Description	Batch
1	D6005-128	Crosstube	B38327

Check OD = 2.750"; ID = 2.000"

a.m 09.04.15 (1)

2.0	MORI SEIKI	MORI SEIKI CNC LATHE LARGE
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**Comment:** MORI SEIKI CNC LATHE LARGE

1-Fill tube with sand & install plugs DT8534 on both ends as per Folio FA113

2-Turn first side as per Folio FA113

3-File down transition lines smooth.

a.m 09.04.15 (1)

3.0	QC1	INSPECT ALL DIM TO DIM SHEET
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**Comment:** INSPECT ALL DIM TO DIM SHEET

a.m 09.04.15 (1)

4.0	MORI SEIKI	MORI SEIKI CNC LATHE LARGE
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**Comment:** MORI SEIKI CNC LATHE LARGE

1-Turn second side as per Folio FA113

2-File down transition lines smooth.

3-Remove sand and plugs

a.m 09.04.15 (1)

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: D212-664-101TRN PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes ☒ No ☐ DQA: P Date: 29/04/20  
 Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

NCR: <u>471145</u>		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			
09.04.15	Z	UD IS 0.005 too small at one section	<u>Q</u> 09.04.15 per QSI 042	Acceptable. MARGINS STILL POSITIVE per attached sheet.	C.m 09.04.15	<u>Q</u> 09.04.15 per QSI 042	<u>Q</u> 09.04.15 per QSI 042	<u>Q</u> 09.04.17

NOTE: Date & initial all entries

Date: Tuesday, 14/04/2009 11:28:09 AM  
User: Linda Lacelle

## Process Sheet

Customer: CU-DAR001 Dart Helicopters Services

Drawing Name: 212/205 HIGH FED X-TUBE ASSEMBLY

Job Number: 47145

Part Number: D212664101TRN

Job Number:



Seq. #:

Machine Or Operation:

Description :

5.0

QC1

INSPECT ALL DIM TO DIM SHEET



Comment: INSPECT ALL DIM TO DIM SHEET

*Q.M. 09-04-15 ①*

6.0

QC8

SECOND CHECK



Comment: SECOND CHECK

*AWM 9-4-15*

*①*

7.0

HAND FINISHING1

HAND FINISHING RESOURCE #1



Comment: HAND FINISHING RESOURCE #1

Chemical Conversion Coat as per QSI 005 4.1

*09-04-15 ①*

*mb*

8.0

QC3

INSPECT POWDER COAT/CHEMICAL CONVERSION



Comment: INSPECT POWDER COAT/CHEMICAL CONVERSION

*Q.M. 09-04-15 ①*

9.0

PACKAGING 1

PACKAGING RESOURCE #1



Comment: PACKAGING RESOURCE #1

Identify and Stock in kanban rack

Location: *X-tube*

*cell*

*MB*

*09-04-15 ①*

10.0

QC21

FINAL INSPECTION/W/O RELEASE



Comment: FINAL INSPECTION/W/O RELEASE

*09/04/17*

Job Completion



*MF 09-04-16*

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

**NOTE:** Date & initial all entries

**DART**

DESIGN <b>PH</b>	DRAWN BY <b>PH</b>	<b>DART AEROSPACE LTD</b> HAWKESBURY, ONTARIO, CANADA	
CHECKED <b>QP</b>	APPROVED <b>[Signature]</b>	DRAWING NO. D212-664-141	REV. C SHEET 1 OF 3
DATE 07.03.08		TITLE XTUBE ASS'Y (205/212/412 HI FWD) NTS	
A	00.12.12	NEW ISSUE	
B	05.02.04	ADD HOLES FOR COMPATABILITY WITH BHT/AA SKIDTUBES	
C	07.03.08	REMOVE -851 ABRASION STRIP; ADD MAGNOBOND 6398, CUSHION, REVERSE CLAMPS	

**RELEASED**07.04.24 **[Signature]**

Qty	Part Number	Description
X	D212-664-141	CROSSTUBE ASSEMBLY (205/212/412 HIGH FWD)
1	D6005-128	CROSSTUBE
2	D2893-1	SUPPORT
4	D3595-063-450	RUBBER CUSHION
4	MS21920-25	CLAMP (OR MS21920-26)
A/R	MAGNOBOND 6398	ROCKWELL SPECIFICATION RBO-120-023 ADHESIVE (TEXTRON/BELL SPEC. 299-947-100, TYPE II, CLASS 2 ADHESIVE)

**GENERAL NOTES:**

- 1) TOLERANCES ARE PER DART QSI 018 UNLESS OTHERWISE NOTED.
- 2) MATERIAL: MANUFACTURED FROM D6005-128  
FINISHED LENGTH = 126.51±0.020
- 3) FINISH: CHEMICAL CONVERSION COAT PER DART QSI 005 4.1  
PRIME INSIDE AND OUTSIDE PER DART QSI 005 4.2  
PAINT OUTSIDE PER DART QSI 005 4.2
- 4) PART IS SYMMETRIC ABOUT CENTERLINE.
- 5) RUN-OFF PART. BLEND OUT EDGE LONGITUDINALLY, TRANSITION SHOULD BE SMOOTH.
- 6) BEND PROGRESSIVELY WITH A MINIMUM OF 3 PASSES. MAXIMUM TUBE FLATTENING DUE TO BENDING IS 6% BASED ON O.D.
- 7) LIQUID PENETRANT INSPECT OUTSIDE SURFACE OF CROSSTUBE PER QSI 038.
- 8) SCRIBE DART PART NUMBER AND BATCH NUMBER IN THIS AREA WITH VIBRATING STYLUS.
- 9) INSTALL D2893-1 SUPPORT USING 0.03" TO 0.06" THICK LAYER OF MAGNOBOND 6398 PER QSI 015. LET CURE FOR 12 HOURS AFTER INSTALLATION AND PRIOR TO PACKAGING.
- 10) INSTALL MS21920-25 CLAMPS (OR -26) WITH D3595-063-450 RUBBER CUSHIONS TO SECURE THE D2893-1 SUPPORT ON TOP SIDE OF THE CROSSTUBE. ENSURE CLAMPS ARE OPPOSITE OF CROSSTUBE SUPPORT
- 11) EXTREME CARE MUST BE TAKEN TO PROTECT THE OUTSIDE SURFACE OF THE TUBE. THE OUTSIDE SURFACE MUST BE SMOOTH AND FREE FROM SURFACE DEFECTS SUCH AS SCRATCHES, NICKS, OR DENTS. DEFECTS UP TO 0.005" MAY BE BLENDED OUT LONGITUDINALLY. CIRCUMFERENTIAL GRIND MARKS ARE UNACCEPTABLE.
- 12) TORQUE CLAMPS 80 TO 100 IN-LB. ENSURE AT LEAST 1.5 THREADS SHOWING IN SAFETY AND THAT NUT HAS NOT BOTTOMED-OUT AFTER TORQUING.

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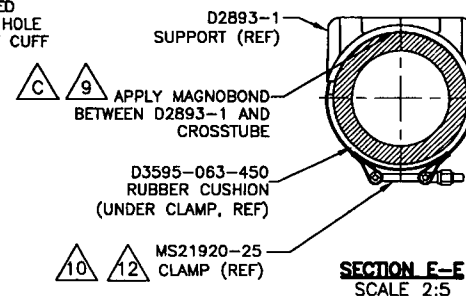
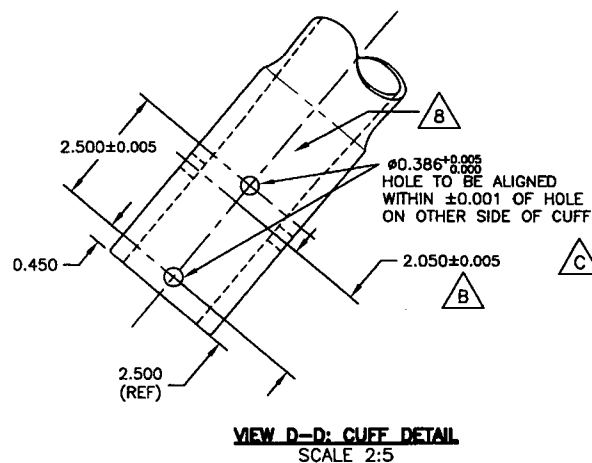
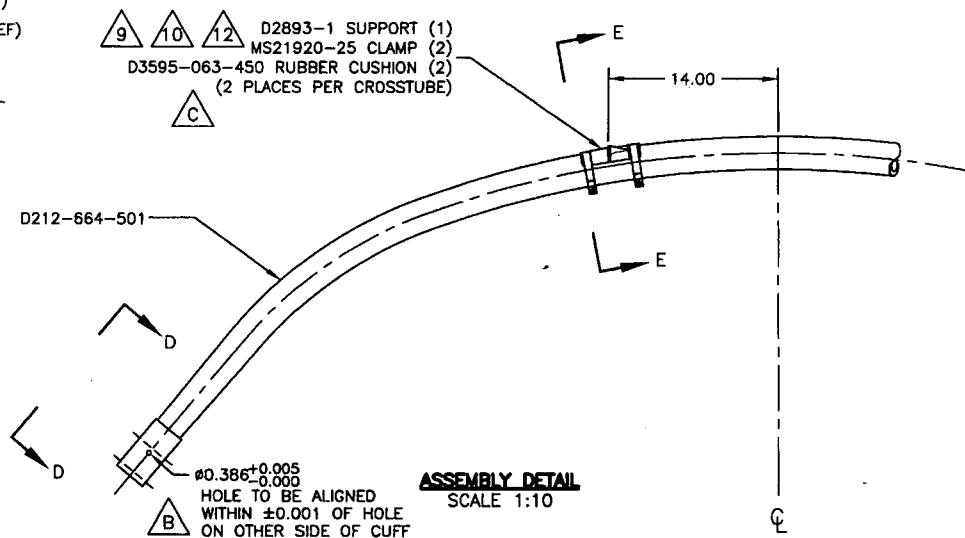
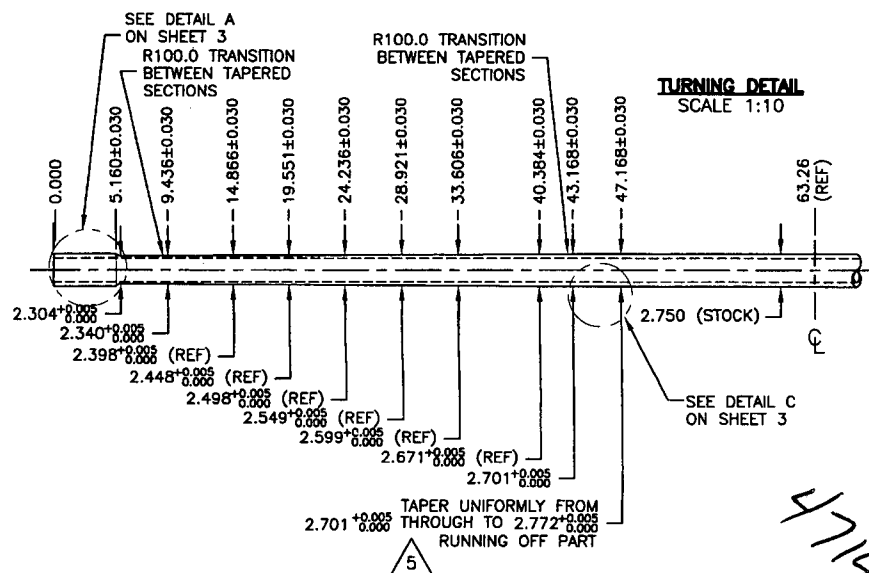
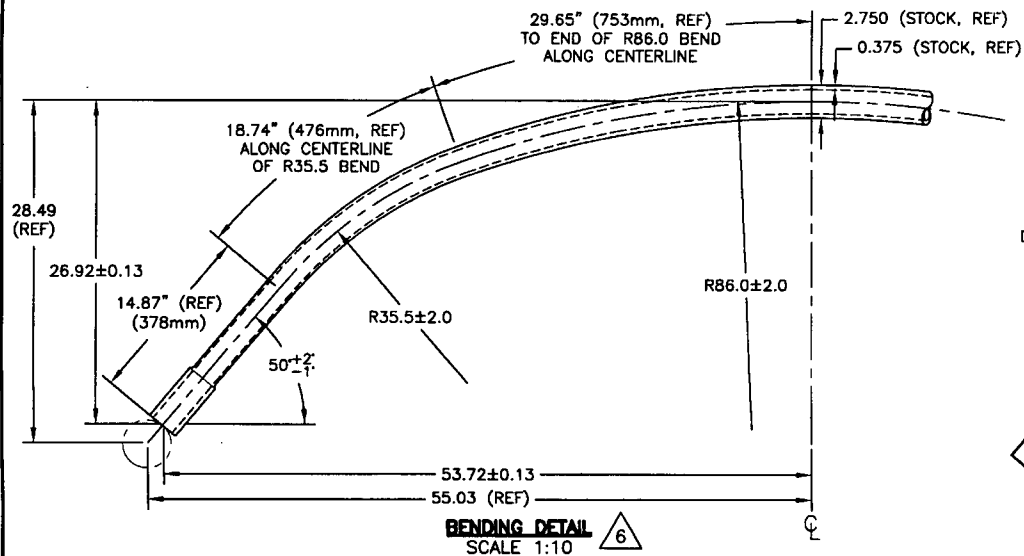
W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

**NOTE:** Date & initial all entries



RELEASED

07.04.24

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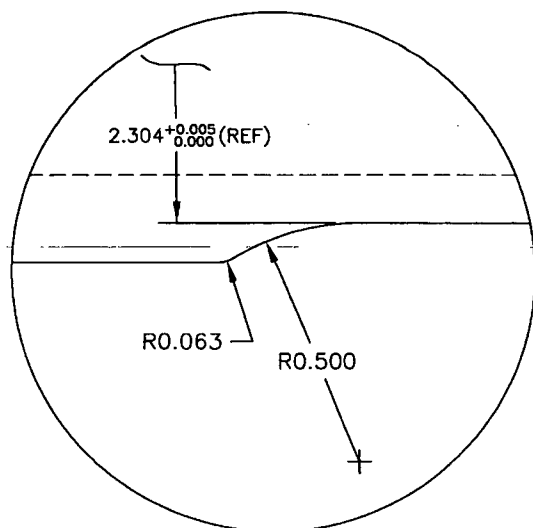
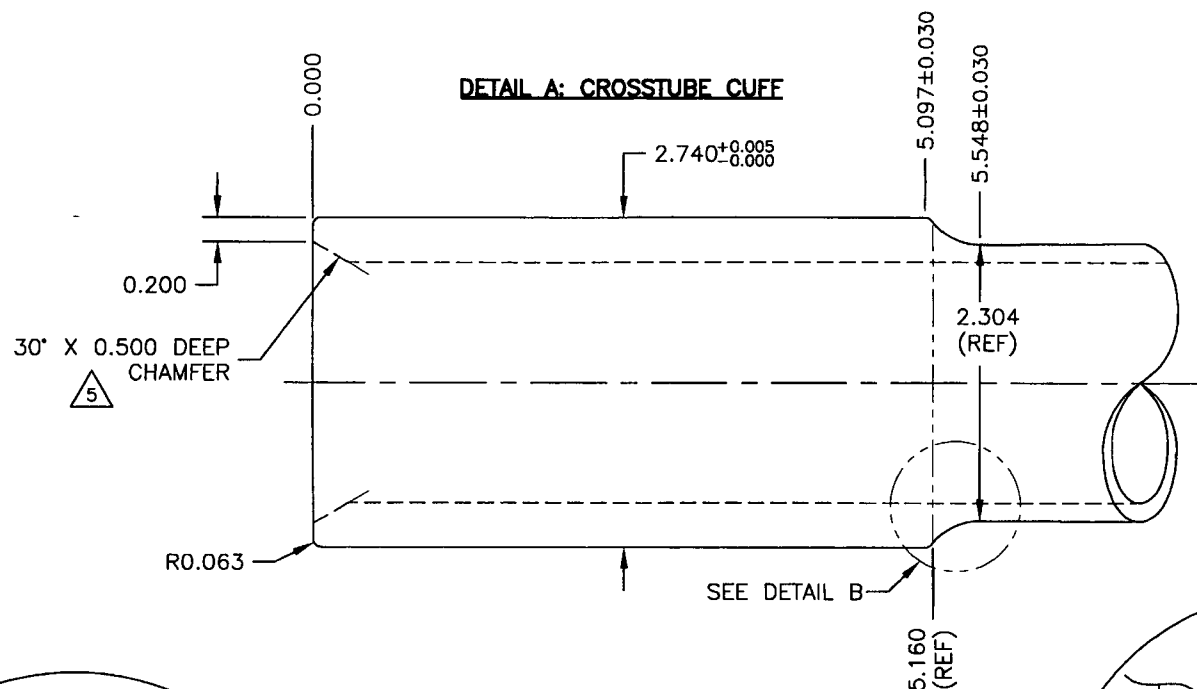
DESIGN	PH	DRAWN BY	PH	<b>DART</b>	DART AEROSPACE LTD. WARRICKSURY, ONTARIO, CANADA
CHECKED	97	APPROVED	4	DRAWING NO.	D212-664-141
DATE	07.03.08	TITLE	XTUBE ASS'Y (205/212/412 HI FWD)	SCALE	1:10

REV. C

SHEET 2 OF 3

**RELEASED**  
 67.04.24 (P)  
 PER DCN 983

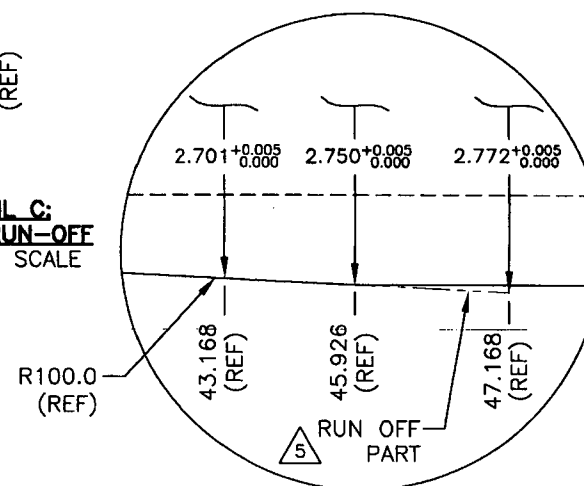
**DETAIL A: CROSSTUBE CUFF**



**DETAIL B: CUFF  
 TRANSITION**  
 SCALE 4:1

47145

**DETAIL C:  
 TAPER RUN-OFF**  
 NOT TO SCALE



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DESIGN PH  
 CHECKED J  
 DATE 07.03.08  
 DRAWN BY PH  
 APPROVED J

**DART** DART AEROSPACE LTD.  
 WILLOWDALE, ONTARIO, CANADA

DRAWING NO. D212-664-141  
 TITLE XTUBE ASS'Y (205/212/412 HI FWD)  
 REV. C  
 SHEET 3 OF 3  
 SCALE 1:1



<b>DART AEROSPACE LTD</b>	<b>Work Order:</b> 47145
<b>Description:</b> Crosstube Assembly (205/212/412 High Fwd)	<b>Part Number:</b> D212-664-141
<b>Inspection Dwg:</b> D212-664-141 <b>Rev:</b> C	<b>Page 1 of 1</b>

### FIRST ARTICLE INSPECTION CHECKLIST

☒ First Article     ☐ Prototype

Inspection Sheet	Drawing Dimension	Tolerance	Actual Dimension	Accept	Reject	Method of Inspection	Comments
SIDE A	0.200	+/-0.010	0.200	✓			
	R0.063	+/-0.010	R0.063	✓			
	2.740	+0.005/-0.000	2.740	✓			
	5.097	+/-0.030	5.112	✓			
	2.304	+0.005/-0.000	2.309	✓			
	2.340	+0.005/-0.000	2.345	✓			
	2.398	+0.005/-0.000	2.403	✓			
	2.448	+0.005/-0.000	2.451	✓			
	2.498	+0.005/-0.000	2.500	✓			
	2.549	+0.005/-0.000	2.544		✓		OK 09.04.15
	2.599	+0.005/-0.000	2.594		✓		
	2.671	+0.005/-0.000	2.660		✓		
	2.701	+0.005/-0.000	2.696		✓		
SIDE B	0.200	+/-0.010	0.200	✓			
	R0.063	+/-0.010	R0.063	✓			
	2.740	+0.005/-0.000	2.744	✓			
	5.097	+/-0.030	5.102	✓			
	2.304	+0.005/-0.000	2.309	✓			
	2.340	+0.005/-0.000	2.345	✓			
	2.398	+0.005/-0.000	2.403	✓			
	2.448	+0.005/-0.000	2.458	✓			
	2.498	+0.005/-0.000	2.503	✓			
	2.549	+0.005/-0.000	2.554	✓			
	2.599	+0.005/-0.000	2.604	✓			
	2.671	+0.005/-0.000	2.676	✓			
	2.701	+0.005/-0.000	2.706	✓			
	126.51	+/-0.020	126.500	✓			

<b>Measured by:</b> am	<b>Audited by:</b> ALIM	<b>Prototype Approval:</b> N/A
<b>Date:</b> 09.04.15	<b>Date:</b> 9-4-15	<b>Date:</b> N/A

Rev	Date	Change	Revised by	Approved
A	05.04.27	New Issue (P/O D412-664-101)	KJ/JLM	
B	06.03.15	Tolerance revised for 5.097 per Dwg Rev update	KJ/JLM	
C	07.05.28	Dwg Rev updated	KJ/JLM	

Excerpt from SR-D212-664-1 Rev A

SECTION	Crosstube	Damage Tolerance	O.D. (in)	I.D. (in)	Area (in <sup>2</sup> )	Inertia (in <sup>4</sup> )
A-A	Bell Fwd	0.000	2.750	2.000	2.798	2.022
	Bell Fwd w/ dam. tol.	0.005			2.786	2.003
	Dart Fwd	0.000	2.750	2.000	2.798	2.022
	Dart Fwd w/ dam. tol.	0.015			2.692	1.894
B-B	Bell Fwd	0.000	2.706	2.000	2.609	1.847
	Bell Fwd w/ dam. tol.	0.005			2.599	1.828
	Dart Fwd	0.000	2.696	2.000	2.567	1.808
	Dart Fwd w/ dam. tol.	0.015			2.423	1.689
C-C	Bell Fwd	0.000	2.605	2.000	2.188	1.475
	Bell Fwd w/ dam. tol.	0.015			2.158	1.424
	Dart Fwd	0.000	2.594	2.000	2.143	1.437
	Dart Fwd w/ dam. tol.	0.015			1.999	1.322
D-D	Bell Fwd	0.000	2.555	2.000	1.986	1.306
	Bell Fwd w/ dam. tol.	0.015			1.956	1.258
	Dart Fwd	0.000	2.544	2.000	1.941	1.271
	Dart Fwd w/ dam. tol.	0.015			1.797	1.157
E-E	Bell Fwd	0.000	2.504	2.000	1.783	1.144
	Bell Fwd w/ dam. tol.	0.010			1.763	1.113
	Dart Fwd	0.000	2.499	2.000	1.763	1.129
	Dart Fwd w/ dam. tol.	0.015			1.619	1.017
F-F	Bell Fwd	0.000	2.404	2.000	1.397	0.854
	Bell Fwd w/ dam. tol.	0.010			1.377	0.825
	Dart Fwd	0.000	2.399	2.000	1.379	0.840
	Dart Fwd w/ dam. tol.	0.012			1.240	0.741
G-G	Bell Fwd	0.000	2.300	2.000	1.013	0.588
	Bell Fwd w/ dam. tol.	0.010			0.993	0.562
	Dart Fwd	0.000	2.304	2.000	1.028	0.598
	Dart Fwd w/ dam. tol.	0.012			0.890	0.501
H-H	Bell Fwd	0.000	2.750	2.000	2.798	2.022
	Bell Fwd w/ dam. tol.	0.030			2.738	1.909
	Dart Fwd	0.000	2.740	2.000	2.755	1.981
	Dart Fwd w/ dam. tol.	0.030			2.581	1.804

SECTION	Cross tube	Bending Ultimate (lb*in)	Bending Yield (lb*in)	Tension Ultimate (lb)	Tension Yield (lb)	Shear Ultimate (lb)
A-A	Bell fwd w/ DT	96147	81580	184007	156127	117095
	Dart fwd w/ DT	106069	90916	207296	177682	110379
	Margin of Safety	0.10	0.11	0.13	0.14	-0.06
B-B	Bell fwd w/ DT	89184	75671	171563	145568	109176
	Dart fwd w/ DT	96455	82675	186565	159913	99340
	Margin of Safety	0.08	0.09	0.09	0.10	-0.09
C-C	Bell fwd w/ DT	72156	61232	142437	120856	90642
	Dart fwd w/ DT	78478	67266	153933	131943	81965
	Margin of Safety	0.09	0.10	0.08	0.09	-0.10
D-D	Bell fwd w/ DT	64967	55124	129063	109508	82131
	Dart fwd w/ DT	70059	60051	138397	118626	73692
	Margin of Safety	0.08	0.09	0.07	0.08	-0.10
E-E	Bell fwd w/ DT	56674	49784	116349	98721	74040
	Dart fwd w/ DT	62696	53739	124673	106863	66384
	Margin of Safety	0.07	0.08	0.07	0.08	-0.10
F-F	Bell fwd w/ DT	45310	38445	90908	77134	57851
	Dart fwd w/ DT	47578	40781	95514	81869	50858
	Margin of Safety	0.05	0.06	0.05	0.06	-0.12
G-G	Bell fwd w/ DT	32243	27358	65549	55617	41713
	Dart fwd w/ DT	33501	28715	68495	58710	36471
	Margin of Safety	0.04	0.05	0.04	0.06	-0.13
H-H	Bell fwd w/ DT	91610	77729	180707	153327	114995
	Dart fwd w/ DT	101390	86906	198720	170331	105812
	Margin of Safety	0.11	0.12	0.10	0.11	-0.08

MARGINS STILL POSITIVE  
w/ OD reduced by 0.005"  
Go tube acceptable

GP  
09.04.15